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Smoke Rings

Newsagents and the "M.E."

IT is very important that readers who wish to ensure the regular purchase of THE MODEL ENGINEER should not change their newsagent if it can possibly be avoided. Also, if for any reason, illness or other cause of absence, a reader is unable to call for his regular copies he should instruct his newsagent to hold them for him. We are obliged to restrict both wholesale and retail newsagents to a precise number of copies, sufficient to fill their regular standing orders, but not a single copy in excess. No newsagent can therefore obtain copies to supply new readers, or to supply a new customer who may be an old reader through another newsagent. Any regular reader who is in difficulty in regard to obtaining his copy is asked to write to us fully explaining the circumstances, and giving the name and address of his newsagent, and also the name of the wholesaler from whom the newsagent obtains his supplies. If it is at all possible for us to remove the difficulty, we shall be pleased to use our best endeavours to do so.

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Some Interesting Models at Pinxton

ALTHOUGH the Pinxton Society always put up a very good show at the model exhibitions they frequently stage, their recent display in aid of the local War Savings campaign was of exceptional interest in the point of historical models. Chief among these exhibits was a collection by Mr. Fred Smith showing colliery winding engines from the period of the original horse-driven gin to the present-day electrically-operated winding gear. There were twenty models in all, and they were shown running by belts from a motor-driven shaft. Other old-timers on view included a beautiful model of an old north-country steam haulage engine, made 70 years ago and loaned by Mr. W. Widdas, H.M. Inspector of Mines. A large-scale model of an old table engine and a half-inch scale model of an American locomotive, contributed by Mr. R. Lucas, of Mansfield, also proved most attractive. The largest locomotive on view was an 1½-in. scale model of the "Flying Scotsman" by Mr. Ernest Dove, and Mr. H. Taylor received a war certificate prize for an unfinished "King George V." Mr. Walter Marriott's model coal-cutting machine, which scored a success at the "M.E." exhibition some years ago, was shown in operation, and an interesting mill engine and boiler was loaned by Mr. A. H. Steele, H.M. Inspector of Mines, of Nottingham. There were some excellent ship models also on view, a notable example being the *Ajax* by Mr. Frank Surgey, of Pinxton, who received the premier award of a silver cup, presented by Dr. Johnstone. Other fine models in this section were a *Queen Mary* by Mr. C. Buttery, H.M.S. *Hood* and a destroyer by Mr. E. M. Cope, and H.M.S. *Southampton* by Mr. S. Lloyd, to which a prize was also awarded. The task of judging was very efficiently performed by Mr. A. J. R. Lamb, the Hon. Treasurer of the London Society. It will be gathered from this brief account of a really good show that enthusiasm runs high at Pinxton. Mr. Fred Smith tells me that as the result of the exhibition several more members of the younger generation have already started on their next models.

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Educating the Norwegians

I HEAR that a party of Norwegian children were recently entertained by Mr. A. G. Beach at his well-known Ken View model railway, in North London, The children themselves were permitted to operate the trains and were hugely delighted with this novel experience. This is the sowing of good seed for the model world, and when Norway is at peace again, recollections of Ken View will perhaps bring many model railways into being in that beautiful country.

Percival Marshall

The London District Forces Exhibition

THIS Exhibition, which was held at the National Portrait Gallery, Trafalgar Square, London, W.1, was organised by the Command Welfare Branch, London District, and comprised a collection of work in all branches of the arts and crafts executed by members of the Forces stationed in the vicinity of London, including the Home Guard and Women's Auxiliary Services; also a representative selection from Allied and Dominion Services. In the majority of cases, the work has been carried out in the spare time of the exhibitors, often under conditions of great difficulty and with the bare minimum of equipment.

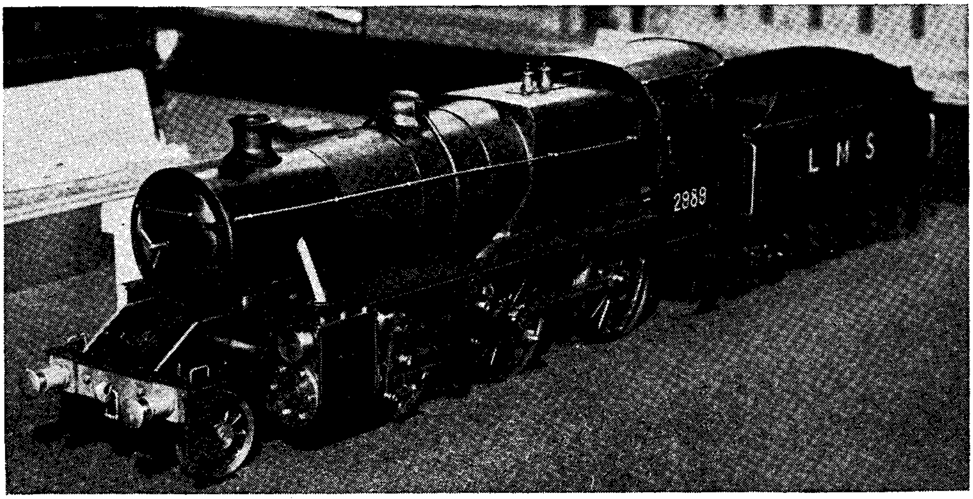
Works of Art

In view of the very wide scope of this Exhibition, it is only natural that many sections of it are outside the scope of this journal; in fact, the great preponderance of exhibits consisted of works of art of every conceivable kind, including paintings in water colours and oils, drawings in pencil, crayon, pastel, carbon and ink, wood carvings, woodcuts and lino-cuts, sculpture, tapestry and embroidery. Beyond noting the fact that many of these exhibits displayed very high artistic merit, and that in nearly all cases the treatment of the widely varied subjects was bold, purposeful and original, it is not proposed to attempt anything of a detailed description of them.

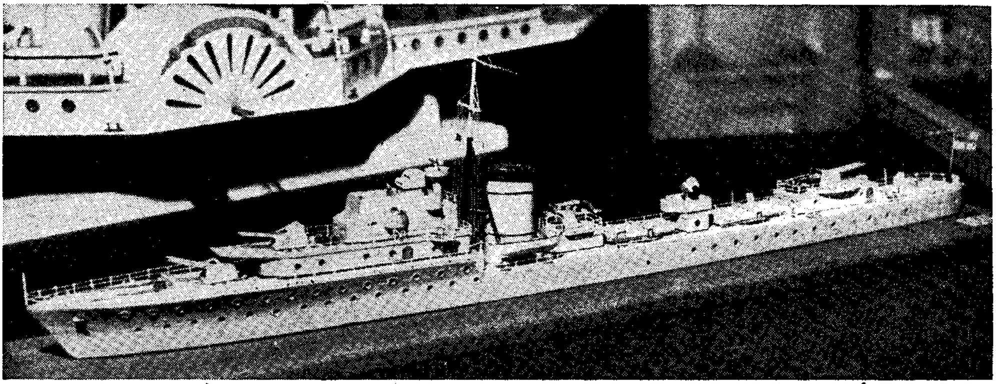
The models, though less numerous than other exhibits, displayed an equal versatility and competence of execution, providing ample evidence that none of the Services is deficient in talent or enthusiasm for good craftsmanship. Facilities and equipment for mechanical model-making are obviously restricted in most branches of the Services, and for this reason the majority of the models were of such a nature that they could be constructed with simple tools, and mostly from readily available materials. There were, however, quite a number of good engineering models, including locomotives, model railway equipment and rolling stock, naval and merchant ships, and aircraft.

Locomotives

One of the most prominent of the locomotive exhibits, and one with which many readers will already be familiar, was the 4-6-0 express locomotive "Wroxham Broad," by Mr. G. R. Stevenson, now serving as a Flying Officer in the R.A.F., who will be remembered as the donor of the "Borneo" Cup and the "Sarawak" Trophy at "M.E." Exhibitions prior to the war. Another



L.M.S. mixed traffic locomotive, by Capt. N. W. Physick.



Waterline model of a 1939 " J " class destroyer, by Seaman S. J. Foate.

interesting model in this class was the L.M.S. mixed traffic loco., by Capt. N. W. Physick.

Model Railways

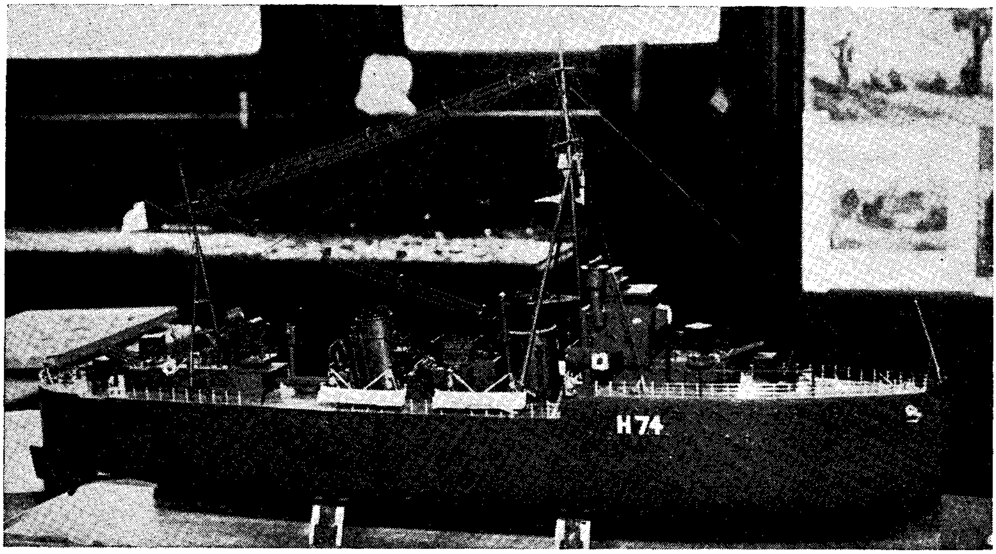
In the model railway section, a number of exhibits by Lt. M. R. S. Hollingworth claimed special attention ; they included a complete railway coach, a section of a coach showing details of work, and railway track sections with points and crossings, in gauge " O." A representative group of scale model freight wagons which displayed excellent workmanship and attention to detail was exhibited by Platoon-Sgt.-Major F. W. Bush.

Ships

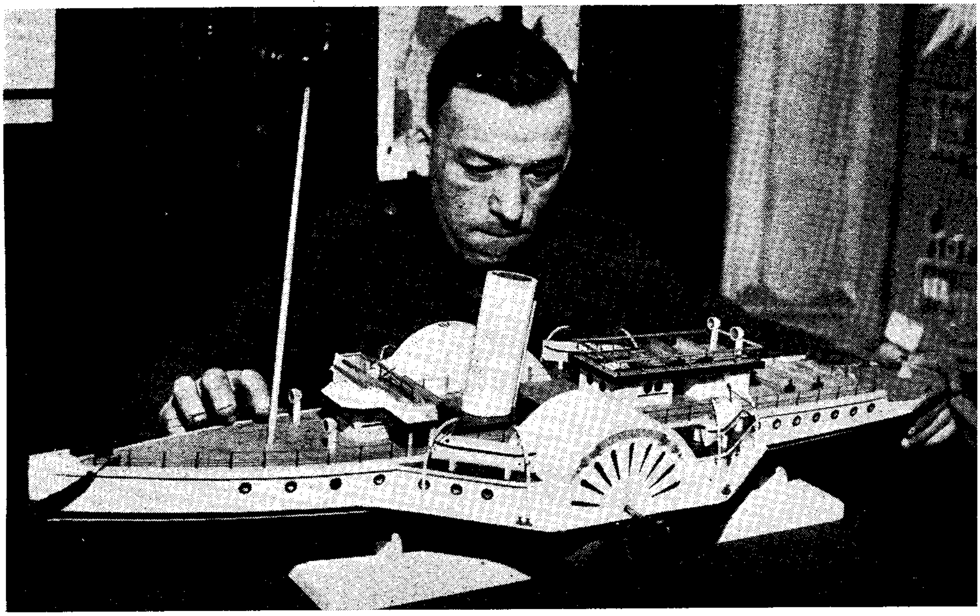
Among the model ships exhibited, the working model " Tribal " class destroyer, by Vol. T. W. Cocker, of the Home Guard, was not only notable for its prepossessing appearance, but was true to character, and appeared to have been built for actual work as well as show. The motive power was not stated, however, and could not be ascertained from external inspection ; this applies also to other models in this class. The paddle steamer " Waverley," by Major R. G. G. Bloxam, was another that also appeared to embody the qualities of a good working model, and displayed careful attention to scale detail and workmanlike finish.

Waterline Models

Waterline models of both ancient and modern craft were fairly numerous ; one of the best in the latter class was the scale model of a 1939 " J " class destroyer, by



Working model " Tribal " class destroyer, by Vol. T. W. Cocker.



Model of the paddle steamer "Waverley," by Major R. G. G. Bloxam.

Seaman S. J. Foate. Several groups of small scale ship models, some in scenic settings, were also exhibited. Many of the old sailing ship models had been built rather with a view to artistic or ornamental effect than to fidelity to type or character, but there were nevertheless one or two meritorious reproductions of historic ships, including the "Victory," by Petty Officer H. Sly, the "Golden Hind," by Vol. G. E. Woods, and a paper model of a ship of the Tudor period by Sgt. A. Jessop, of the R.A.F. A group of ship models by L.-Cpl. J. A. Hetherington, including two cargo boats, an oil tanker, and the clipper "Cutty Sark," calls for special mention as an example of high-class craftsmanship.

Aircraft

Aircraft models included quite a number of scale and free-lance flying models, and still more small scale solid models in which practically all Service and commercial types of modern aircraft were represented. A very carefully made skeleton model of a Short "Sunderland" flying boat, incorporating the unusual feature of working controls operable from the cockpit, was exhibited by L.A.C. R. A. G. Newman, while Vol. C. O. Hughes exhibited scale models of the Lockheed-Hudson, Supermarine "Spitfire," and Bristol "Beaufighter."

A most unusual, and, to the lay mind, rather gruesome, model exhibit, was a case of models of wounds sustained in air raids, modelled from actual cases by Capt. H. E. Crocker. These were just a little too realistic to be really pleasant to look at !

Houses

Architectural models included several examples of houses and planning schemes, some of which must undoubtedly have represented idealistic conceptions on the part of the exhibitors—it would scarcely have been correct to term them just "castles in the air," however, in view of their practical nature and execution. This probably applies to the dainty little model "Casa Mia," by L.-Cpl. A. N. McIntosh. A rather conspicuous model, on a fairly large scale, was the model railway station by Rfn. J. Chandler, which was built to a scale of 7 mm. to 1 ft.

Theatrical Models

Some examples of model theatre craft were also shown, including a group of stage settings for Shakespeare's "Macbeth," Sheridan's "The Rivals," and Marlowe's "Faustus," respectively, by L.A.C. N. E. Gibbs. In this department may also be mentioned a group of 11 wooden marionettes by Lt. V. Podesnik (Czechoslovakia). Most of the models shown by Allied exhibitors were of a type which defies classification in the normal categories, but their originality of conception and skilled execution deserve great praise.

The Boiler Fittings for "Molly" —

The $3\frac{1}{2}$-in. Gauge L.M.S. 0-6-0 Tank Locomotive

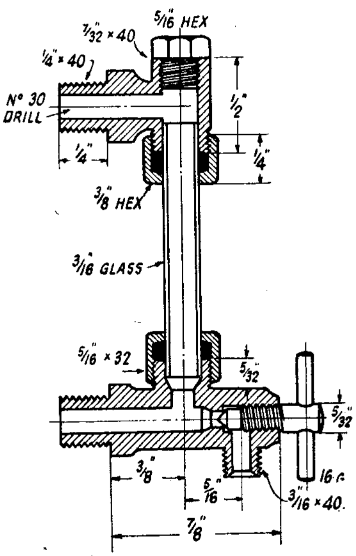
By "L.B.S.C."

THERE are, apparently, a number of followers of these notes who have become locomotive builders since I last described how to make fittings for the boiler backhead; and as back numbers are now practically unobtainable, I have received requests to deal with the fittings for "Molly" in some detail. All serene! anything to oblige, as long as our good friend with the blue pencil doesn't object. So here are some sketches and a somewhat abbreviated description of the necessary gadgets. There are slight variations to what has appeared in the past, e.g. the whistle turret is arranged for vertical mounting, for reasons described below; so that old-time readers may still find the notes as useful as ever.

Water Gauge

This is the type I nicknamed the "Stroudley-Washington," because it has a blowdown valve just like old Billy's; and also, like his, it never gives false readings provided it is kept clean and the boiler is free from grease inside. No castings are needed, the whole gadget being made from rod material; any kind that won't rust will do at a pinch, even common "screw-rod," but if you can get a bit of decent gunmetal or bronze, naturally, you get a better class of fitting. A piece of 5/16-in. round rod is first chucked in the three-jaw; face the end, centre, and drill down a full $\frac{1}{2}$ in. with a 3/16-in. clearing drill, say No. 11. Screw about $\frac{1}{8}$ in. of the outside 5/16 in. by 32 with a die in the tailstock holder, and part off $\frac{1}{2}$ in. from the end. Reverse in chuck, and tap the other end 7/32 in. by 40 for about 3/16 in. depth. Drill a 5/32-in. hole exactly in the middle of its length.

Chuck a bit of $\frac{3}{8}$-in. rod in the three-jaw; face, centre, and drill down about $\frac{5}{8}$ in. with No. 30 drill. Turn down $\frac{1}{4}$ in. of the end to $\frac{1}{4}$ in. diameter, and screw $\frac{1}{4}$ in. by 40; part off at 9/16 in. from the end. Make a tapped bush to hold the various bits of the fittings when they have to be turned and drilled at opposite ends, and must be held truly; just chuck a bit of $\frac{1}{2}$-in. round rod about $\frac{1}{2}$ in. long, face, centre, and drill right through with 7/32-in. drill. Countersink the end slightly with $\frac{1}{4}$-in. clearing drill ($6\frac{1}{2}$ mm. or letter "F"), tap $\frac{1}{4}$ in. by 40, using the tailstock chuck to hold the tap, face off the end again to remove any burr, and put a centre-dot or some other mark opposite No. 1 jaw, so that you can always rechuck the bush truly. Screw the previously-turned piece into this, and with a roundnose tool turn it down to $\frac{1}{4}$ in. diameter, just far enough to leave a collar about 3/32 in. thick and $\frac{3}{8}$ in. diameter, next to the screw. Then with a knife-tool, turn down another 1/16 in. or so, to a tight drive fit in the 5/32-in. hole in the side of the piece you made previously, and squeeze it in. The distance between centre of hole and the shoulder should be $\frac{3}{8}$ in., see sketch. Make a plug to fit the top,



The water gauge, in section.

from $\frac{1}{4}$-in. hex. rod; chuck the rod in three-jaw, turn down about 5/32 in. length to 7/32 in. diameter, screw 7/32 in. by 40, part off to leave a head about $\frac{1}{8}$ in. thick, reverse in chuck, and chamfer the hexagon head.

For the nuts, chuck a bit of $\frac{3}{8}$-in. hexagon rod; face, centre, drill down about $\frac{3}{4}$ in. depth with No. 11 drill, open up to 3/16-in. depth with 9/32-in. drill, tap 5/16 in. by 32,

part off at ¼ in. from the end; reverse and chamfer. Make two.

For the bottom fitting you need a piece of ⅜-in. rod 1⅛ in. long, which can be parted off a rod in the chuck. Turn down one end of it to ¼ in. diameter for ¼ in. length, and screw ¼ in. by 40; centre, and drill down ¾ in. depth with No. 30 drill. Now chuck it in the screwed bush. Turn down to 5/16 in. diameter with a roundnose tool, leaving a collar at the end as before. Face the end and slightly chamfer it; centre, and drill down with a 3/32-in. or No. 43 drill until you break into the other hole. Open out to a bare ¼ in. depth with No. 30 drill, and bottom the hole with a ⅛-in. D-bit (all your D-bits can easily be home-made from ordinary silver-steel) so that the total depth is 9/32 in.; tap 5/32 in. by 40, and don't let the tap hit the seating and destroy its truth.

At ⅜ in. from the shoulder, drill a 5/32-in. hole into the centre passage; at 3/16 in. from the tapped end, and diametrically opposite (that sounds good!) to it, drill another ditto. Fit nipples into both these holes. To save repeating the description of this operation on other fittings, all nipples are made thus: chuck a bit of rod the requisite diameter in three-jaw; or if you haven't a bit, then use the nearest size larger, and turn it to suit. Face, centre deeply with a centre-drill, drill down about 5/16 in. depth with suitable drill according to diameter of nipple (see illustrations), screw the outside with a die in tailstock holder, part off, reverse in chuck, and turn about 3/32 in. of the tail end, to a tight squeeze fit in the holes in the body of the fitting which have been drilled to receive them.

Note: the 5/16-in. nipple in the lower gauge fitting is counterbored 3/16 in. clearing, to a depth of ⅛ in. bare, to accommodate the bottom end of the gauge glass. The two nipples and the joint in the upper fitting are then silver-soldered, and as I have described silver-soldering for other parts of "Molly," you don't need details of that. Suffice it to say that I always use a Bunsen burner, made from a 6-in. length of ⅜-in. boiler-tube, for silver-soldering my fittings, and no blowlamp or air-pressure feed is needed. They are quenched out in a one pound jam-jar half full of acid pickle (and *not* in my workshop, it is hardly necessary to add!) and polished up with a circular wire brush mounted on a taper shank, stuck into a taper hole in the end of the spindle of my electric grinder, which goes nearly 3,000 r.p.m. and doesn't half make them "bob," as we used to say on the old "Brighton."

The pin for the blowdown valve is made from 5/32-in. rustless steel or bronze, either nickel or phosphor does equally well. Chuck in three-jaw, and turn a blunt cone point; this can be done either by setting over the top slide to an angle of 45 degrees, or else using a tool ground off on the slant. Next, turn down about 3/32 in. length to ⅛ in. diameter, then screw the next ¼ in. with a 5/32 in. by 40 die in the tailstock holder. Part off at 9/16 in. from the end, drill a No. 53 cross hole through it, and fit into that a piece of 16-gauge silver or rustless steel, ⅝ in. long, with the ends rounded off. I find this is better than a wheel for those unlucky individuals who have very tender fingers, because the handle doesn't get so hot, and if your fingers happen to be greasy, the handle affords a better grip than a wheel. "Billy's" gauges on the Brighton engines had cross handles to the blowdown valves.

Many first-timers get into a shocking tangle when they screw the fittings into the boiler-bushes and find they won't line up properly for the insertion of the gauge glass, the net results usually being either stripped threads or broken spigots, plus railroad Esperanto *ad lib*. Well, if you screw the fittings home reasonably tight and find they won't line up, make a pin-drill from a bit of 7/16-in. round steel, with a pin or pilot 7/32 in. diameter, a nice fit in the bushes.

If you haven't a bit of tool steel or silver-steel, use ordinary mild steel, and case-harden it well. Turn down the shank end to fit a drill brace; a carpenter's crank brace is the best for the job. Then, if your fittings are what Mrs. 'Arris calls "contrairey," just apply the pin-drill to the offending boiler-bush and take a skim off the contact face. By this means you can, with a little care, get the top and bottom fittings to lock home dead tight, and yet allow the glass to slide in easily. Put a smear of plumber's jointing on the threads, and use the 3/16-in. clearing drill as a gauge. When you can put it through the top fitting, and it falls "all by itself" into the counterbore in the lower one, then the mountings are lined up O.K. for the glass. Try it with the gland nuts in place.

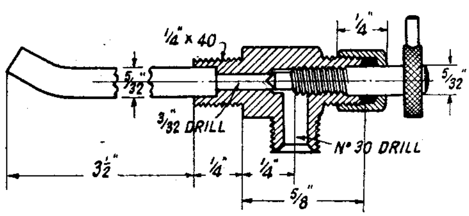
To make the packing rings, chuck a bit of 3/16-in. rod in the three-jaw. On this, slide an inch or so of rubber tube (red or grey) of such a diameter that when on the "mandrel," the gland nuts will just go over it. Now set the lathe going as fast as possible, and touch the rubber tube at 3/32-in. intervals with a *wet* safety-razor blade which is no longer sharp enough for its legitimate purpose. When the rubber tube is pushed off the rod, it will fall into a number of perfect little packing rings.

The 3/16-in. glass tube can usually be obtained at the local chemist's shop, if he

sells what I call "medical glassware," such as funnels, test tubes, etc. No special kind is needed; just the ordinary soda-glass does fine. It is easily and cleanly cut, merely by nicking with a three-square file, and breaking off. The length of glass is correct when the bottom end is home in the counter-bore and the top just below the steam passage; see illustration. To insert, wet the glass and two of the packing rings. Put the glass through the top fitting, slip on a packing ring (easy when wet) then the two gland nuts back to back, and then another ring. Let the glass drop into the counter-bore, hold it there with a bit of rod down the top fitting, and run the gland nuts home. They should take the packing rings with them. Screw up as tight as you can with fingers only; there should be no necessity to use a spanner. Insert the top plug with a smear of plumber's jointing on the threads, and the gauge is complete.

Injector Steam Valve

Chuck a bit of $\frac{3}{8}$-in. round rod in the three-jaw. Turn down $\frac{1}{4}$ in. length to $\frac{1}{4}$ in. diameter, screw $\frac{1}{4}$ in. by 40, face the end, and part off at $\frac{7}{8}$ in. length. Rechuck in the tapped bush mentioned above. Turn down and screw the other end likewise; then centre, drill right through 3/32 in. or No. 43; open out with No. 30 drill, and bottom with a D-bit to $\frac{1}{2}$ in. depth. Open out a further $\frac{1}{8}$ in. with No. 21 drill, and tap the smaller part 5/32 in. by 32 or 40, taking care not to damage the seating. At $\frac{1}{4}$ in. from the shoulder, drill a 5/32-in. hole into the central passage; make a $\frac{1}{4}$-in. by 40 nipple to fit this, as described above, and squeeze it in. Reverse the piece again, and open out the other end to about $\frac{1}{8}$ in. depth with No. 22 drill. Fit a $3\frac{1}{2}$-in. length of 5/32-in.



The injector steam valve, in section.

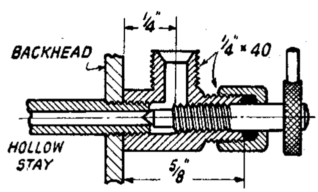
copper tube into this, and silver-solder both that and the nipple at the same heat. Pickle and clean up. The valve pin is made exactly the same way as the one on the water gauge, except that it is 13/16 in. overall length. You can either fit a cross pin, or a little brass wheel $\frac{3}{8}$ in. diameter, with a peg in the rim, like the hand wheels on the valves of "Molly's" big sisters. If the latter, drill a 3/32-in. hole in the wheel boss, punch it square by driving a bit of 3/32-in. square silver steel through it, and file the end of the pin to suit. Harden and temper the silver-steel to dark straw, and grind the end off dead square. The gland nut is made the same as described for water gauge, and packed with a few turns of graphited yarn.

Bend the end of the steam pipe slightly, exactly opposite to the nipple, and screw the whole gadget in the top right-hand boiler bush. When right home, the nipple should point downwards, and the end of the steam pipe will be close to the top of the firebox wrapper. Dry steam is needed for proper working of the injector.

Make another valve exactly the same, except that the end has no steam pipe in it, and is turned and screwed 3/16 in. by 40 instead of $\frac{1}{4}$ in. This is a supplementary shut-off valve for the steam brake, and is screwed into the top of the wrapper close to the turret and whistle valve. I will give further fitting details when we connect up the steam brake pipes.

Blower Valve

Chuck the $\frac{3}{8}$-in. rod again; face, centre, drill down $\frac{1}{4}$ in. depth with No. 22 drill, tap 3/16 in. by 40, and part off $\frac{5}{8}$ in. from the



The blower valve, in section.

end. Reverse in chuck; turn down $\frac{1}{4}$ in. of the outside to $\frac{1}{4}$ in. diameter, and screw $\frac{1}{4}$ in. by 40. Face, centre, drill right through with No. 30, open out with No. 21 to about $\frac{1}{8}$ in. depth, and tap the rest of the hole 5/32 in. by 32 or 40. Drill a 5/32-in. hole $\frac{1}{4}$ in. from the plain end, and fit a $\frac{1}{4}$-in. by 40 nipple in it, silver-soldering it in place. The valve pin and gland nut are exactly the same as the injector steam valve, and the whole gadget is screwed on to the end of the hollow stay, with the nipple pointing skywards, see illustration.

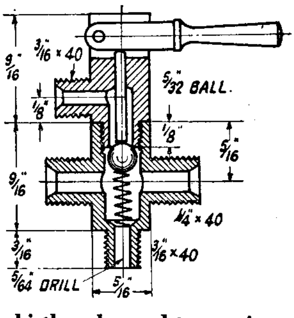
Combined Turret and Whistle Valve

As the boiler projects only $\frac{3}{8}$ in. or so into the cab, and the latter is fairly high, the turret is arranged vertically. Chuck a length of 5/16-in. round rod in the three-jaw; turn down 3/16 in. of the end to 3/16 in. diameter, screw 3/16 in. by 40, and part off $\frac{3}{4}$ in. from end. Reverse in chuck; face, centre, drill right through with 5/64-in. or

46 drill, open out to ½ in. depth with 3/16-in. drill, and tap the end 7/32 in. by 40. Slightly countersink the end, and skim off any burr. At 5/16 in. from this end, drill clean through both sides with a 5/32-in. drill, fit a ¼-in. by 40 nipple in each hole, and silver-solder them.

Chuck the rod again, turn down ⅛ in. of the end to 7/32 in. diameter, and screw it 7/32 in. by 40. Centre, and drill down about ¾ in. depth with No. 51 drill. Open out to 5/16 in. depth with No. 32 drill, and poke a ⅛-in. parallel reamer in, to true up the end. Skim off any burr, and part off at 11/16 in. from the end. At ⅛ in. from the shoulder, drill a 5/32-in. hole, and fit and silver-solder a 3/16-in. by 40 nipple into it. In the other end, cut a cross slot 7/32 in. deep and a full 1/16 in. wide; if you haven't a 1/16-in. milling or slotting cutter, saw it, and finish with a little file as used for truing up contact-breaker points on automobile engines; or an Eclipse "4S" slotting blade comes in just right for a job like this.

Seat a 5/32-in. rustless steel ball on the end of the reamed hole, then assemble as shown in the sketch, with a light brass



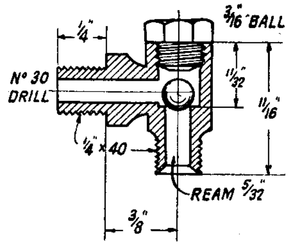
The whistle valve and turret, in section.

spring in the recess in the lower part of the fitting, to keep the ball on its seating when there is no steam in the boiler. The upper and lower nipples should line-up. A piece of rustless steel or bronze wire, 1/16 in. diameter and a bare ½ in. long, is then dropped into the top of the fitting, and rests on the ball. The handle is turned from 5/32-in. steel or bronze rod, the tail being filed flat to enter the slot, and it is pivoted on a piece of a domestic pin driven through holes drilled in the fitting, and through a clearing hole in the lever. Pressure on the handle depresses the ball, and lets steam from the boiler blow through the upper nipple, which in due course we shall connect up to a proper L.M.S.-note whistle under the running board, so that little "Molly" will be able to "sing" like her big relations.

Drill and tap a 3/16-in. by 40 hole directly over the regulator gland, in the edge of the backhead, so that it goes through both the wrapper sheet and the backhead flange, and screw the fitting into this with the usual "anointing" on the threads. The unions should stand at right-angles to the centre line of the engine, otherwise they will foul the cab weatherboard; but the handle can be at any angle you please, or in line with the regulator.

Clack Boxes

Two are needed, one each for injector and hand-pump feeds. Chuck the ⅜-in. rod again,

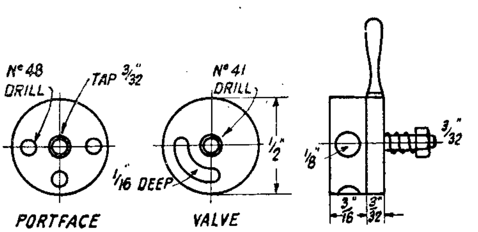


Feed clack, in section.

and take a skim off the outside, to reduce to 11/32 in. diameter; then turn down ¼ in. length to ¼ in. diameter, screw ¼ in. by 40, centre deeply, but don't drill. Part off at 11/16 in. full from the end. Reverse in chuck; centre, drill right through with No. 24 drill, open out and bottom with 7/32-in. drill and D-bit to 11/32 in. depth; poke a 5/32-in. reamer through the rest of the hole. Tap the upper part ¼ in. by 40, and dodge the seating as before; countersink slightly, and skim off the burr. At 7/32 in. from the top, drill a 5/32-in. hole into the side; and in this fit an exact replica of the bit you made and fitted to the upper part of the water gauge. Silver-solder it in; pickle and clean up. Seat a 3/16-in. rustless ball on the D-bitted hole, and make a little cap from 5/16-in. hexagon rod, of such a length that the ball gets 1/32-in. lift. The clacks are screwed into the lower bushes, with the screwed stems pointing downwards.

Steam Brake Valve

Chuck a bit of ½-in. rod and face the end;



Details of the brake valve.

centre, and drill No. 48 for about ⅛ in.

(*Continued on page 346*)

*LOCOMOTIVE HEADLAMPS —

In this week's instalment (No. 5) Mr. F. C. HAMBLETON deals with the Metropolitan and District Railways

IN steam-traction days, the old Metropolitan & District Railways were once aptly described with regard to their locomotives as fortunate and fascinating.

Fortunate indeed they were, for the 120 4-4-0 side-tanks which they owned between them, and which had all been built by Messrs. Beyer, Peacock & Co., proved so successful that the whole stud was practically identical in design. This was really rather wonderful considering that Metropolitan Railway No. 1 was built in 1864, and the last of the race, District Railway No. 54, as late as 1886. Fascinating, too, the locomotive enthusiast found them, for when the smoke screen of sulphurous steam which filled the Underground system of those days lifted awhile, a particularly curious type of engine, resplendent in olive green or dark red, met his eye. Polished brass domes and elegant copper-capped chimneys reflected the pale gleam of the gas lamps that bravely endeavoured to light the way of the passenger along the smoky platform.

The engine headlamps, too, added their quota of interest. As previously mentioned, they closely resembled the L.N.W.R. lamps, for they carried a white and red "hollow lens" at the front and back respectively. They also had double-coned reflectors, and were held in position by means of a square foot which slipped into a cast-iron socket bolted to the buffer beam. However, these lamps, unlike their relatives at Crewe, could stand firmly on their own feet. This balancing trick was achieved with the aid of a kind of rectangular skirt, which was attached to the bottom of the lamp, and in the sides of which were semi-circular openings to allow the clearance of the foundation plate of the lamp socket, this latter, incidentally, being of the same pattern as that of the L.N.W.R.

* *Continued from page* 306, "*M.E.*," *March* 26, 1942.

The Original Lamp

Fig. 1 shows the original Metropolitan Railway lamp, with its recessed side panel which acted as a stiffener to the body. When the District Railway appeared in 1871, the same type was employed, but with flat sides and a taller handle. These District lamps were painted white with the number of the engine on the side in black. This was the only record of the number of the engine visible to the eye, since the first batch of 24 engines were lettered A to Z. Later, when they received Nos. 1 to 24, in lieu of letters, the lamps were painted black, and no numbers were put on them. Evidently it was deemed sufficient for the collector of engine numbers that the numbers were shown by brass numerals attached to the front of the chimney, or by those of white on the buffer beams. Like the L.N.W.R. at this period a lamp bracket over each buffer sufficed for all the route indications, but as time passed and the District Railway system grew, a centre iron on the buffer

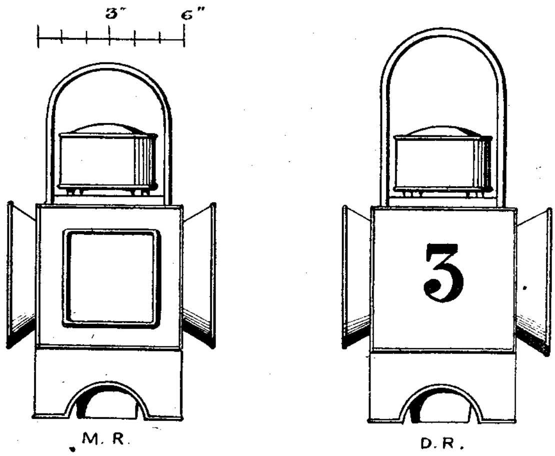


Fig. 1.

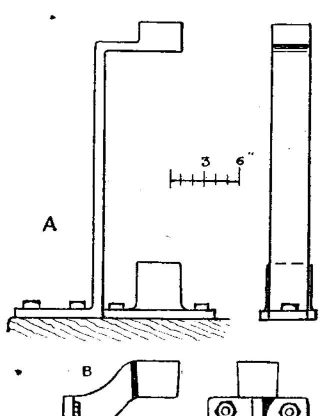


Fig. 2.

beam sported a white or white and spot headboard. Next, a tall lamp-iron was placed above the original one on the off-side of the buffer beam, Fig. 2, A. When some 30 years later the L.B.S.C.R. opened the through "Quarry line" to Brighton, thereby avoiding Redhill, they, too, employed the system of upper and lower lights. Was the hint taken from the old District Railway?

As the District Railway grew and grew, yet another bracket was added, this time near the top of the smokebox (Fig. 2 B), but not quite on its centre line, for this position was already occupied by the time-honoured chain which held up the smokebox door in

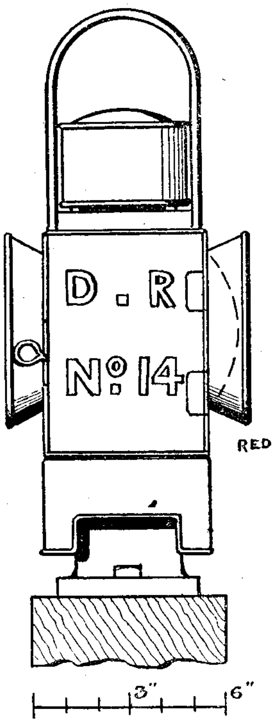


Fig. 3.

threatening position at tube-cleaning time! Finally, a very similarly shaped bracket supplanted the centre headboard iron, making a nice little quintet to adorn the front end of the engines. By this time, the lamps had changed their proportions somewhat, as may be seen by reference to Fig. 3. The bodies had grown longer, and the openings in the foot became rectangular. Ownership was proclaimed by white lettering on the lamp's side, although the company could run to only one full stop in D.R!

The Metropolitan Railway was more conservative. True, the recessed panel disappeared, as did the lenses which retired into the body of the lamp as if for better protection (Fig. 4), but otherwise they differed but little from their prototypes. In modern times, the lenses (now solid glass) once more project from the body of the lamps, and the skirt has vanished—such are modern fashions! (Fig. 5.)

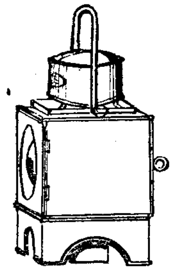


Fig. 4.

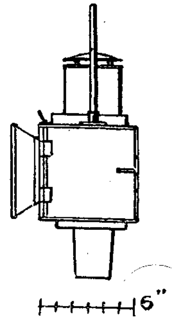


Fig. 5.

For years now the Metropolitan engines have carried two lamp brackets over each buffer, but as they are arranged horizontally, they afford an interesting variation of the old District Railway practice.

(To be continued)

"Molly's" Boiler Fittings

(Continued from page 344)

depth. Part off a slice 3/16 in. thick; face again, and part off a 3/32-in. slice. Drill three No. 48 holes halfway through the face of the thick one, as shown in the illustration, and drill three $\frac{1}{8}$-in. holes in the thickness of the piece, to meet them. Tap the middle hole 3/32 in. or 7 B.A., and countersink it slightly.

Open out the hole in the thinner piece with No. 41 drill, and countersink it. On the faced side, cut a sausage-shaped slot as shown, a bare 1/16 in. deep, with a little chisel made from a bit of silver-steel rod. In the edge, and opposite to the slot, screw a little handle turned from $\frac{1}{8}$-in. rod. Face both parts of the valve, as described for slide valves and so on; screw a stud made from 3/32-in. rustless steel or bronze wire into the thick one, put the thin one over it, and secure with a spring and nut. The spring should be made from 22 gauge wire. The way this valve is installed and connected will be given after the boiler is erected on frames and the final "plumbing" work is dealt with.

*Making a Division-Plate

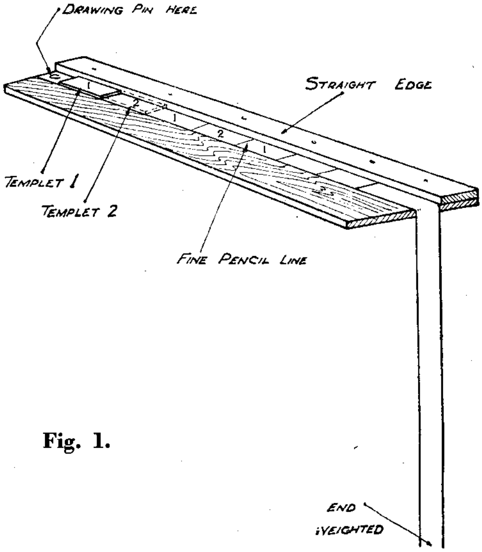


Fig. 1.

A method proposed by Mr. H. O. CLARK

MR. FOOKS in his letter on page 141 of the current volume calls for suggestions for making division-plates with the appliances usually found in a model engineer's workshop. I suspect that Mr. Fooks knows more about this subject than most people, and it is with a certain amount of diffidence that I put forward the following suggestions.

Make a rough wooden disc of the maximum diameter that can be swung in the lathe gap. Turn the rim and the face. This disc need only be a rough affair ; mine was made of two strakes of double-width shelving crossing each other and nailed together, the nails being long enough to clinch over at the back. I do not approve of putting unnecessary time and finish into jigs, fixtures, and the like. These are only "means to an end." To the face of the wooden disc attach your division-plate, which in this instance I made 6 in. diameter of 3/16 in. thick hard brass roughly sawn to shape. Six 1 in. No. 8 wood screws will serve to hold this in place. The number of holes required is 17, and by a coincidence my wooden disc is 17 in. diameter. The circumferential pitch therefore is π, that is 3.1416 in.

I divide the circumference of the disc by strips of a flexible material. I have tried part of a surveyor's tape, a strip of stencil copper, of cartridge paper, but on the present occasion I used a $\frac{3}{4}$-in. strip torn from the edge of a roll of tracing cloth. To make the division lines on this strip, proceed as follows :—Make two templates of thin sheet metal about $3\frac{1}{8}$ in. long, exact length is of no consequence. The important point is to make both templates exactly the same length. Take a piece of smooth board about 5 ft. long, and towards the bottom nail another piece to form a straight edge. Fasten the tracing cloth strip, dull side up, by a drawing pin at one end and let the other end overhang the board, tension being maintained by a weight. Place one of the templates on the left-hand end with its base guided by the straight edge. With a chisel point on a very hard pencil (I use a 4H) strike two lines at the ends of the first template. Take the second template and apply it to the end of the first template and strike another line ; remove No. 1 to the other end of No. 2, and strike another line, and so on until you have 18 lines scribed on your tracing cloth. This scheme is illustrated in Fig. 1.

Now turn the rim of the disc until the starting and finishing lines of the canvas strip exactly meet ; more care is required here than in any other part of the process. When you have made the diameter correct, fasten the strip to the wood by common domestic pins, one at each end will suffice.

The Drilling Operation

Let us now turn to the actual drilling operation, and in this particular I consider it necessary to drill all holes through a jig. This I make from a piece of $\frac{3}{4}$-in. square steel bent to a right-angle and with a hole drilled near the end of the short leg. This hole is 0.1 in. diameter, and this region is case-hardened. Set this jig on the tool slide and advance the slide rest until the jig is practically touching the division-plate. Place the drill in the jig and prove that the setting is square in both directions. The actual drilling is done by means of a portable electric drill fed in by hand. "Wandering" of the drilling machine has no effect on the drilling, as the drill itself is flexible and has a long guide in the jig. A rough sketch of this arrangement is shown at Fig. 2.

* *An entry in our recent Division-plate competition.*

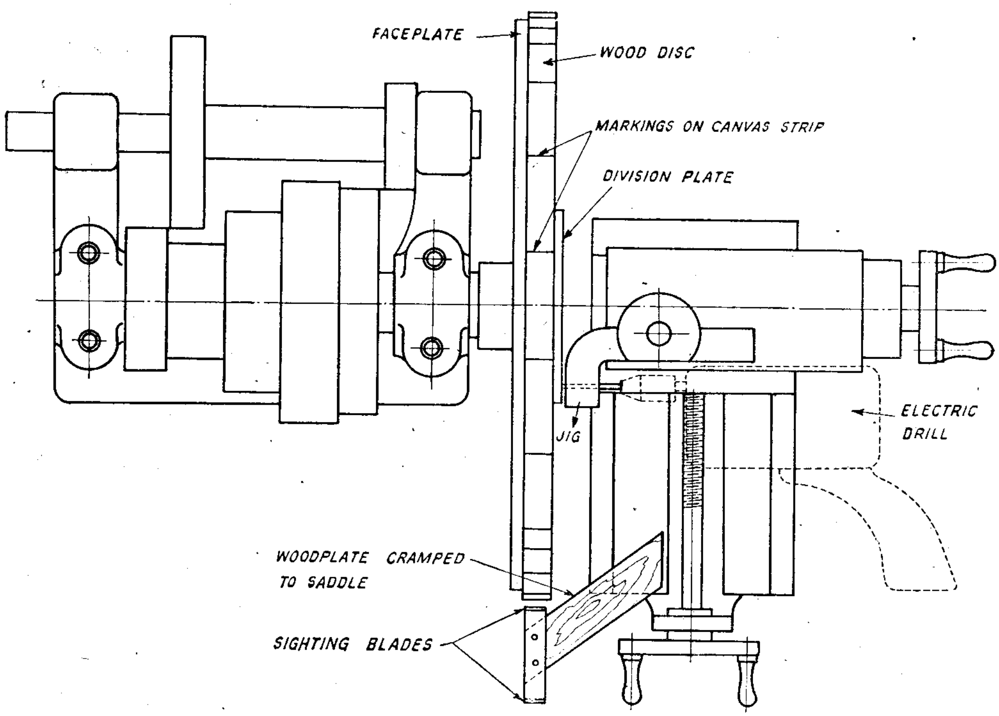


Fig. 2.

The actual indexing I did as follows :—First remove the cap of the neck bearing of the lathe and put a stencil copper liner on the top. By tightening down the cap the lathe mandrel is a fixture. By slackening the bolt the lathe mandrel runs very easily and without stickiness, this is very necessary. To index the divisions on the canvas tape I have used various devices. The simplest is a flat plate clamped to the slide rest and set as closely as possible to the tape. This answered fairly well but on the present occasion I used a U-shaped strip of brass mounted in such a way as to give a similar reading to a pair of builder's boning-rods, as shown on Fig. 3.

I have since found time to check the accuracy of the divisions. The chordal pitch or spacing I find is correct in six instances, seven others are below nominal by the following amounts :—

1—0.001. 1—0.0015. 3—0.002. 2—0.003.
The remaining four are over nominal by the following amounts :—

2—0.001. 1—0.002. 1—0.006.

This is not sufficiently accurate for my liking, and the inaccuracy is due to my impatience to get the job done, and quite overlooking the fact that my eyesight is not so good as it was. I must certainly make another, making use of someone with better eyesight.

After writing this description I decided to make a plate. Whether it is of sufficient accuracy to meet Mr. Fooks' ideas I cannot say. I do know, however, that this method of making division-plates for average work

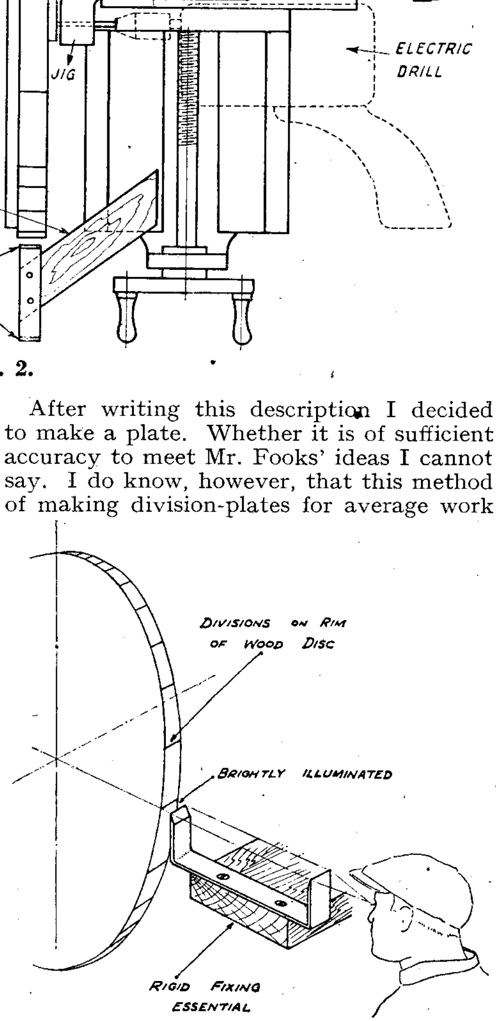


Fig. 3.

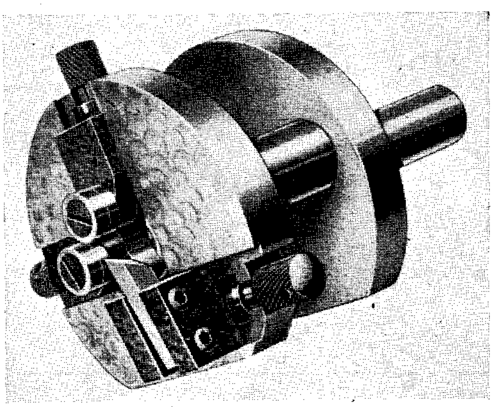
is quite satisfactory. On a windmill model I have made I required such odd numbers as 93, 67, 26 and 23, and wheels cut from division-plates made in this manner ran very satisfactorily.

*Small Capstan Lathe Tools

Notes on "tooling up" for repetition work, with special application to the small capstan attachment recently described in the "M.E."

By "NED"

IN the early part of this series of articles some advice was given on the subject of ready-made capstan lathe tools, in response to enquiries from readers as to where such tools could be obtained (see the issue of the MODEL ENGINEER dated October 23rd last). Since then, a good deal of information about ready-made tools has been furnished by manufacturers, and it is understood that the position with regard to the supply of tools is steadily improving, though the private user of a small capstan lathe would probably still find it difficult to obtain them without an official permit. The size of most tools listed by manufacturers is also well on the large side for adaptation to lathes within the scope of these articles. Nevertheless, it has been decided that descriptions and illustrations of available tools are justified on the grounds of general interest; most of them are very ingenious in design, and embody refinements not usually found in the tools which are made "on the spot" to cope with immediate machining problems. A study of these tools will prove profitable to the user of any small production lathe, whether he makes his own tools or otherwise; and the interests of the manufacturers, even though they may not be directly served by the promotion of sales, will certainly not be harmed by publicity given to their products.



A tangential roller steady tool, as manufactured by Messrs. R. G. Boardman & Co., Birmingham.

A Roller Steady Tangential Tool-holder

Messrs. R. G. Boardman & Co., 44, Summer Row, Birmingham, have furnished particulars of a very ingenious roller steady tool, which happens to possess several features in common with the tool illustrated in Fig. 9 (March 12th issue), though considerably more elaborate in design. It is made in two sizes, the "Minor" having a work capacity up to ½ in. diameter, and the "Major," with a capacity up to ¾ in. diameter. Shank diameters may be varied to suit requirements.

An interesting feature in the design of this tool is that the cutter and rollers are not mounted directly on the backplate, but on an extra plate which is carried in front of the backplate on rigid spacing pillars. The advantage of this method of construction is that work up to the full capacity of the tool in diameter may be operated on for a greater length than is possible where the ordinary backplate mounting is adopted. This length is, in any tool of this nature, limited by the distance from the front edge of the cutter to the backplate, though the use of a hollow shank enables small diameter work of much greater length to be run down.

Both the roller slides, and also the tool slides, have positive screw adjustments to suit the diameter of work to be turned. The tool box, in which the cutter is secured by two sunk set-screws has its groove set at the required angle to provide clearance in both planes. It is claimed, quite justifiably, that this form of tool holder gives exceptional swarf clearance, maximum tool life, and a wide capacity range. There are no projections in front of the tool point, so that it may be used right up to a large diameter flange or shoulder on the work.

Drilling and Boring Operations

Work requiring a centre hole should first be centred by means of a centre-drill, or a flat drill, as described in the October 9th issue, and may then be drilled in the customary manner by any form of drill held axially true in the capstan head. Small twist drills may be mounted in a standard drill chuck the shank of which is turned to fit the capstan head socket. The cheapest and simplest types of drill chucks are quite suitable for this purpose, and can be obtained with parallel shanks of a standard diameter,

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* *Continued from page 292, "M.E.," March 26, 1942.*

which involve the minimum work in adapting them. If, however, no suitable chuck is available, a length of mild steel rod of the required diameter, or turned to suit, may be concentrically drilled to fit the drill, and the latter secured in place by a grub screw (Fig. 12). The drill shank should fit the hole closely so that it is not forced out of centre by the screw; in some cases tool setters prefer to make the drill a drive fit in the holder, or sweat it in, to provide maximum security.

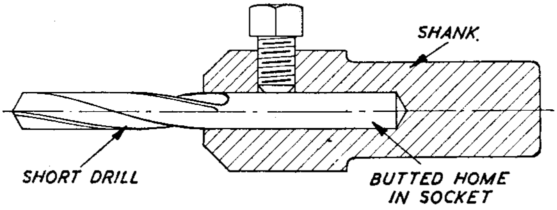


Fig. 12. Short twist drill mounted in stub holder to fit capstan head.

Drills should not project farther beyond the chuck or holder than is necessary, as a long slender drill lacks rigidity and is more liable to damage in every way than a short one. Very often drill stubs which have worn down too short for efficient use in a drilling machine can be given a new lease of life in a capstan lathe. If possible, the shank of the drill should bottom in the chuck, so that it cannot possibly slip back to destroy end-stop adjustment; sometimes it is necessary to use a short piece of metal rod as a packing piece behind the drill to ensure positive location.

In cases where holes have to be drilled very deeply, it is often an advantage to start with a short drill and follow up with a longer one, so that the maximum rigidity is obtained at the beginning of the operation, when the drill is most likely to wander out of truth. It may even be desirable to do the operation in three or more stages, and crowding of the capstan stations may be avoided by using a form of drill chuck which permits easy and rapid changing of the drill.

It is of the highest importance to run the lathe at the right speed for efficient drilling; small holes require a higher speed than most users seem to realise, and deficiency in this respect results in slowing up of output, excessive drill wear, and liability to concentric inaccuracy. The use of a rotating drill spindle in the capstan head is justified in some special cases, though the complication of arranging a suitable drive, which can be unshipped to allow for the rotation of the capstan head, rules it out for the majority of simple production lathes.

Reamering and Boring

When holes have to be highly finished internally, or to a close accuracy in size, simple drilling may fail to produce the desired results, and in these cases an undersize hole will have to be drilled, to be opened out to size by a reamer or boring tool. The ordinary hand reamer, which cuts mostly on the sides, near the leading end, is not really a suitable tool for this purpose, as the holes are usually blind, and in such cases it cannot produce a parallel hole; neither is it sufficiently free in its cutting and clearing action. An old hand reamer, broken or ground off fairly short, and reground so as to cut on the nose end, will serve the purpose much better, but a simpler tool to produce is a small D-bit or flat sizing cutter.

The amount of material left to be removed by the reamering operation should be as small as possible, and it is advisable to use, in the preliminary drilling operation, a size of drill which is found to leave just a mere scrape for the reamer to take out. Conventional rules in reamering sizes do not necessarily apply, as the exact size a particular drill will cut cannot always be predetermined.

Boring operations, as distinct from reamering, are often required in small capstan lathe work when it becomes necessary to open out a hole to a fairly considerable extent. It often happenes, when producing a large hole, that it is more efficient to drill a small pilot hole and bore it out, than to attempt to drill the required size of hole at a single operation, with a large drill. The latter may require more power than is readily available, and will set up a very heavy end thrust, which may be bad for the lathe headstock bearings. When a large drill is not used at its proper cutting efficiency, violent chattering may be set up, and the

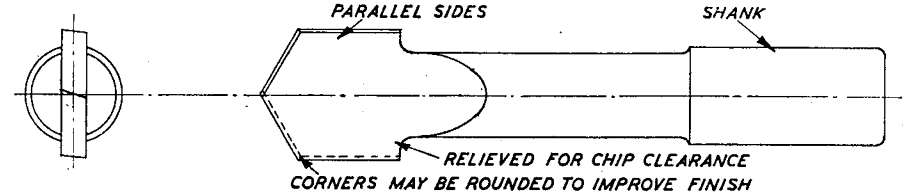


Fig. 13. Form of flat drill recommended for opening out and sizing holes.

hole produced may be far from circular.

Single-point boring tools can be used for capstan lathe work, and are in certain cases useful or indispensable ; but for most purposes, double-edged tools are preferable, not only because of their greater cutting efficiency, but also in order to ensure accurate sizing. The cutting pressure is

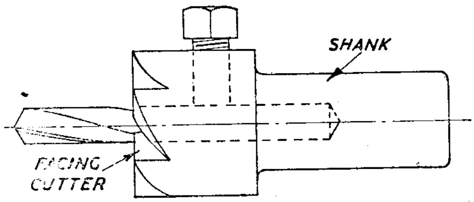


Fig. 14. Combined drill and face cutter, suitable for shallow counterboring.

balanced so that side thrust on the work is eliminated. A common form of boring tool is the good old-fashioned flat drill, but instead of being made diamond-pointed, the diametral edges are ground parallel for a certain distance back from the lips, as shown in Fig. 13, so that regrinding of the latter does not affect the size of hole the drill will produce. It is not, however, invariably an advantage to grind the sides to produce cutting edges ; indeed, better results are often obtained when they are not backed off, providing that the front edges are kept properly sharp. The form of drill shown in Fig. 2 (October 9th issue) would be quite suitable for opening out short bores, but would clear better in deep holes if the diameter were relieved from about half an inch behind the cutting edge.

Inserted-cutter tools, with flat, square section or even round cutter bits, are also quite extensively used in capstan lathe practice, and are easily made up to suit the work in hand. The cutter bar may be made of mild steel bar of a suitable diameter to fit the capstan head socket, and it may be desirable to form a pilot on the leading end. The only disadvantage of such tools in production work is that the size of bore which they produce is altered when they are reground, unless an elaborate form of " expanding " cutter is employed.

Cored holes in castings are often troublesome to bore out properly, owing to the fact that they are initially out of truth, and the scale or sand in them causes heavy tool wear. It is usually best to open them out in not less than about three stages, using flat drills with obtuse-angled lips, so that the tendency of the drill to follow the eccentricity of the hole is reduced. The first drill should take a sufficiently heavy cut to get well below the " skin " of the metal, and should be ground with clearance on the sides ; it will probably call for frequent regrinding, so it should be mounted in such a way that it can be removed and replaced quickly with as little disturbance to the setting as possible.

Counterboring Tools

When the depth and annular dimensions of the counterbore are considerable, a flat drill, either with or without a pilot, is the most efficient form of tool to use for the job. In some cases drilling and counterboring are carried out in one operation, either by a special one-piece combination drill or by means of a facing cutter equipped with a twist drill in place of the usual pilot (Fig. 14). The small capstan lathe user, however, will generally find it better to carry out the drilling and counterboring in two distinct operations, as this is not only lighter on the lathe, but also on the tools ; it simplifies tool setting, and enables a better check to be kept on the accuracy of both operations.

For shallow counterboring, in cases where the tool must be kept keen and adjusted to produce an accurate diameter, the form of tool shown in Fig. 15 will be found useful, and is easy to make. The cutter is of square

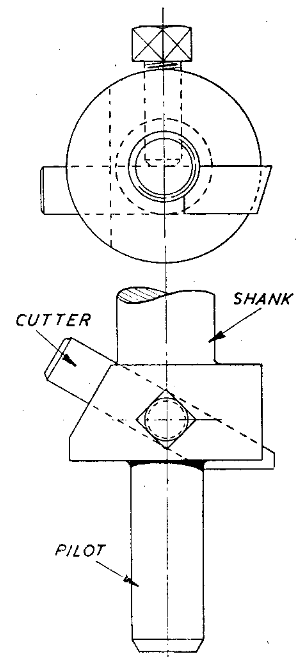


Fig. 15. An efficient single-point counterboring tool.

section, fitted in a diagonal slot at about 60 degrees to the axis, an arrangement which facilitates re-grinding and size adjustment. It is, of course, important that the front edge should be ground too so as to set exactly square with the axis (unless some other

angle is called for in the job being dealt with) and for this reason some kind of grinding jig is advisable for this operation.

A pilot is provided to guide the cutter concentrically with the hole, and if the tool is required to cut over the entire annular area, both the cutter and the slot to which it is fitted must be arranged so that the entire radial face is operative; any dead space between the inner end of the cutting edge

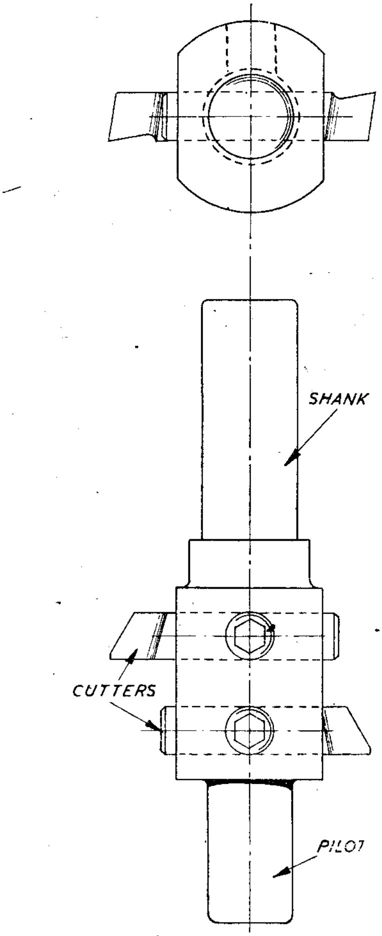
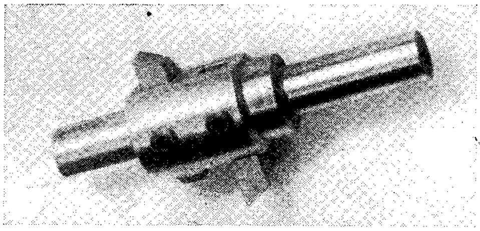


Fig. 16. Two-step counterboring tool, suitable for light operations.

and the pilot will prevent the tool from cutting properly. Incidentally, this is quite a common fault in the design of counterboring tools, but one which is quite easily avoided by the exercise of a little common sense. It will, of course, be clear that if the counterbore is required to penetrate to any great depth, the cutter must be shortened so that the back end does not foul the enlarged bore.

Step counterboring of different diameters is very frequently necessary in capstan lathe work, and although it is possible to do this by taking successive cuts with counterbores of different sizes, a single tool to do the job is more convenient and expeditious in cases where the amount of metal to be removed is not very great. Fig. 16 shows a simple two-step counterbore for use in a hole which has already been opened out with a flat drill to a size sufficient to clear the largest



The two-step counterbore shown in Fig. 16.

diameter of the holder. If, however, it had to be capable of opening out the pilot hole directly, the leading cutter could be arranged similarly to that of the preceding example.

This tool was made for use on a gunmetal electrical fitting, and saved a good deal of time, compared with that taken up with separate tools, without imposing excessive strain on the lathe. Its general construction calls for no special description, as it is adequately explained in the illustrations.

(*To be continued*)

MORE SOLDERING HINTS

Soldering-up a leaky or spring joint does not offer any special difficulty, as the solder (tin-lead or tin-lead-antimony alloy) can usually be made to flow over the defective area, but in the case where it is necessary to solder up a fair-sized hole, it is not so simple, as the solder will not flow over and cover up the hole, but flows around it, merely reducing its diameter a little. For such jobs it is useful to keep in the workshop an assortment of various small sizes of tinned iron or copper rivets, or even brass paper-fasteners; cut off nearly all the shank of one that is a suitable size just to fit over the hole and apply zinc chloride or Fluxite over the rivet head. Then use a well-tinned soldering bit, and a sound and neat soldering job will result. A good way to prevent solder from getting into places where it is not wanted, such as tubes, joints, etc., is to fill them with a fairly thick paste made by mixing powdered chalk and water.

To prevent solder straying over model parts where it is not wanted, cover the parts with a paint made by mixing lampblack and water to which a little weak glue or size has been added.—A. J. T. E.

Mr. J. W. Pattison

Designs a Lathe —

and Suggests some Gadgets for it

TO prevent any misunderstanding, as I do not wish to start any argument on lathe design, let me state as briefly as possible just why this article ever came to be written at all.

First, then, let it be said that, like many others, I am very interested in making accessories, or gadgets as they are now commonly called, to further the scope of my lathe.

To facilitate this process, I keep an exact scale drawing of my present lathe, and whenever any additional part is required which I intend to make, reference to the drawing provides all the measurements necessary and saves endless time measuring up on the actual lathe itself, which at its best can be a dirty job, and dirty hands are not very helpful on a drawing board.

Gadgets

Evidence that many more like myself are interested in gadget making, or of otherwise improving their lathes, will be found by referring to almost any back number of this journal, where a multitude of articles have been written, bringing to light many excellent ideas for our benefit.

Speaking for myself, I take great interest in these articles, and many of the ideas set forth have been adopted to my own needs ; and as to their success, I have yet to make one that had to be shelved. Added to this, many original ideas of my own have been carried out from time to time, with the result that I now have available quite a respectable accumulation of very interesting and useful gadgets, many of which are in constant use.

All of these improvements, however, have been of a minor character, and in no way alter the basic design of the lathe ; yet I have often thought, had my lathe been made of a more plastic material than cast-iron, it would, times without number, have been moulded into a variety of different shapes to further the adoption of gadgets !

A Third Hand

One such gadget which, almost of necessity, requires an alteration of the lathe bed, and one which I had often desired to make, might be described as a sort of third hand to the lathe itself. Something where one could fasten a piece of work and still have available the benefits of the wide range of movements of the slide rest on which to mount tools or appliances to carry out the necessary machining.

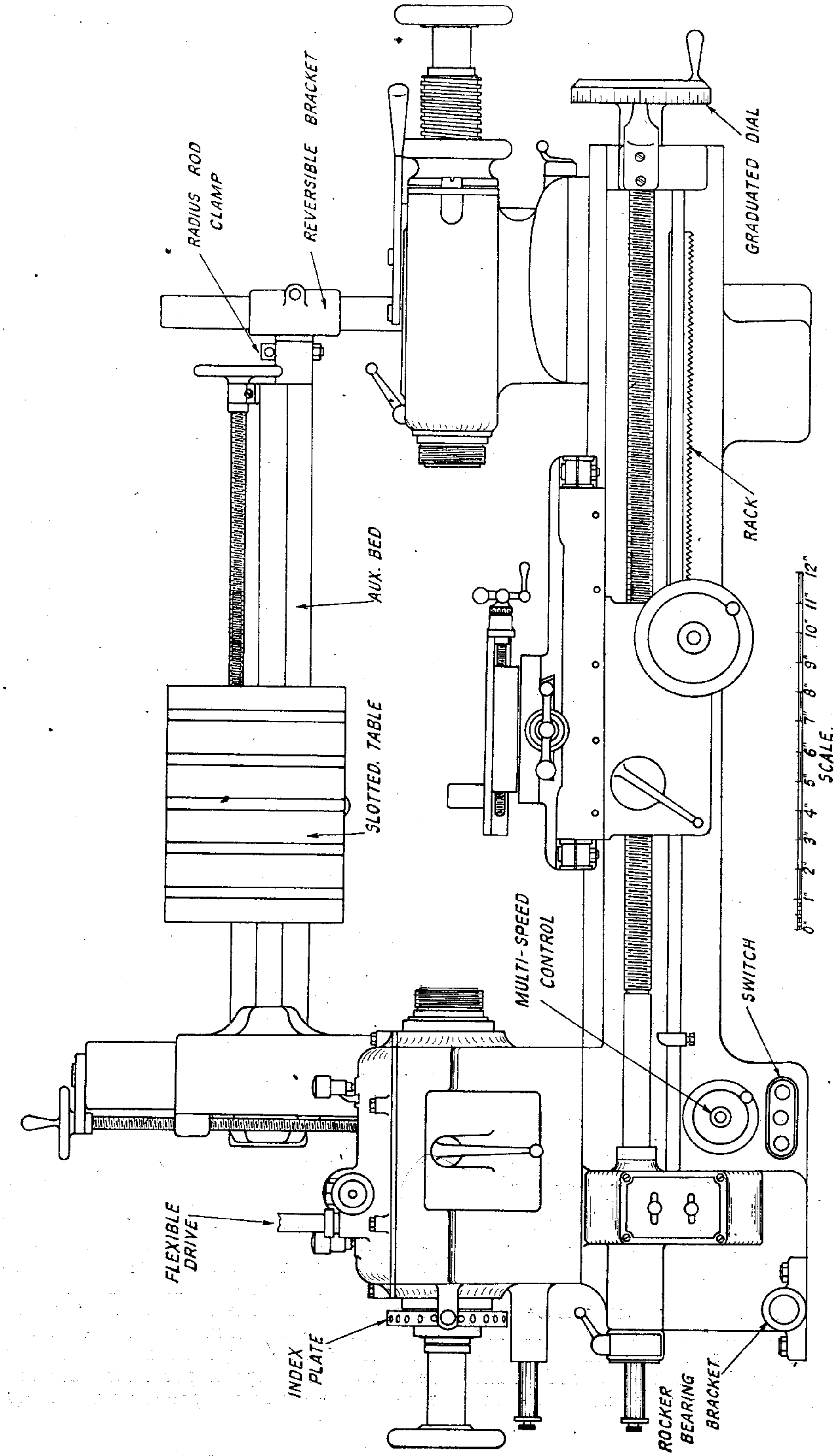
Yet another gadget desired was one to solve the difficulty that often crops up, the devising of some form of auxiliary drive, adaptable to any rotatable tool which has to travel about in a variety of directions. We all know that difficulty, and the overhead is not always an easy method of solving it.

I did get over these two difficulties on my own lathe, be it said in a somewhat primative way ; but it was in the process of drawing out the design that made me wish for that more plastic material already referred to.

A Pictorial Version

It was then that I decided to kill two birds with one stone, for, having taken great interest in the recent discussions on lathe design, I decided to mould my lathe into a more convenient design, at least on the drawing board, thus giving me a pictorial version of what I wanted.

Having drawn it out for my own amusement, it then occurred to me that it might provide interesting entertainment for others if it was accompanied by a description. It is not put forth, of course, as any attempt to solve the "ideal lathe" question, that would take a much more intrepid person than I, since I am inclined to regard the answer to that question as somewhat mythical, considering the wide diversity of opinion as to what constitutes an ideal lathe. In fact, I wonder if there can be such a thing as an ultimate ideal, since when examining my own drawing there was a great urge to alter this or that as ideas took shape. Therefore, to me at any rate, what would at one moment appear to be ideal soon disappeared, to an extent depending upon one's desire to improve on it. All this, however, is quite a different thing from saying I would not be content with such and such a lathe ; indeed, I feel quite satisfied with the one I own at present ; and although it is far from my ideal, I have no intention of changing it for any other. That being so, the design is put forth only as of general interest at the present time, though



Front elevation of Mr. J. W. Pattison's design for a model engineer's lathe, showing some of the gadgets fitted.

I do hope it will induce others to produce a scale drawing of similar interest. No doubt they will find as many snags as I did, when they come to put their ideas on paper; but, above all, let us have the original ideas included and without fixing price limits, although a measure of simplicity will have to be included, otherwise the design will surely get out of hand, as there would appear to be no limits when once a start is made. Since no thought of production is being contemplated, there is no need to let price upset ideas. If, however, anyone does hope to see his design produced, no doubt the prospective manufacturer will whittle down the design until it reaches his price limit. Any thought of manufacture never entered my mind, so price didn't interfere, though much thought was given to simplifying the various parts. Here's hoping, therefore, that any interest taken in this article will form a bait for others to come forward with their lathe designs, not necessarily ideals, though incorporating one or two original ideas, or should I say ideas originally applied in case there is any misconception as to their origin. To this I had better add, that I claim no originality in my own drawings.

Drawings

Now a word about the drawings. I have given plan, elevation and end views in preference to a projected view, in case anyone wishes to read off dimensions. Sectional drawings of all the parts would take up too much space, although, of course, they had to be made before the outline drawings could be arrived at. In lieu of sections I have included a description so that readers may form an idea of what is hidden from view.

General Features of the Design

The machine was designed to mount on top of a bench, without cutting away any of the latter and to operate as a complete unit without any separate motor, belting, countershaft, or overhead gear other than that which was part of the machine itself. There had to be no belts to change, and as much as possible of the mechanism to be enclosed. Also, there would have been no gear wheels to change, but that was found to be impracticable unless some limit was set on the number of threads to be cut. After considering that the amateur uses his lathe to cut worms and spirals, the necessity of very fine feeds at times, and also, at odd times, the driving of the leadscrew independent of the mandrel, not to mention many other uses to which loose gear wheels can be put, the adoption of the simple quadrant and standard set of change wheels was preferred to the quick-change version with limited uses. Not a convincing argument I admit, but it scores in simplicity and in its universal application, and the more universal the machine can be made the better, at least from the amateur's point of view.

Electricity being available, advantage was naturally taken of this as a source of power. Normal accessories such as chucks, faceplate, angle-plates, etc., are assumed to be available and are therefore not included in the drawings.

The Bed

This is a box form casting closed at the top and open at the bottom, well ribbed inside, and with plenty of metal in it, to ensure rigidity. Extensions cast with the bed support the motor and columns. Three-point suspension is adopted, with rockers at the headstock end and a sphere at the tail end. This form of anchorage provides a ready means of upending the machine to get at the mechanism underneath necessary, since there are no inspection plates. As, however, there is little underneath to require inspection, that task will only occur at very long intervals and would be simple enough when it did occur. Besides this, all bolting-down strains are relieved from the bed.

The axis of the mandrel is offset from the centre line of the bed, the principal object here being to get adequate support immediately underneath the turning tool without overhanging the front edge of the bed any more than was reasonably necessary. Added to this, the offsetting allowed for an entirely separate way to be formed, along which the saddle could travel without touching any part of the bed traversed by the tailstock.

Comparatively large wearing surfaces were provided for a lathe of this size, yet even if wear did occur, this could not affect the original alignment of the head- and tailstock.

No Gap

No gap was thought necessary, since the centres were raised to $4\frac{1}{2}$ in. This height was adopted for two reasons, first it provides a fair maximum turning size for an amateur's lathe, although a gap could easily be got by scooping out the bed immediately underneath the faceplate, whilst still retaining the desired front way the entire length of the bed. The second and most important reason was to get ample room over the saddle. The top and vertical faces of the front shear of the bed take practically all the pressure of the turning tool, the balance being taken on a section of the bed not touched by the tailstock.

(*To be continued*)

A 30-c.c. Four-Cylinder Engine

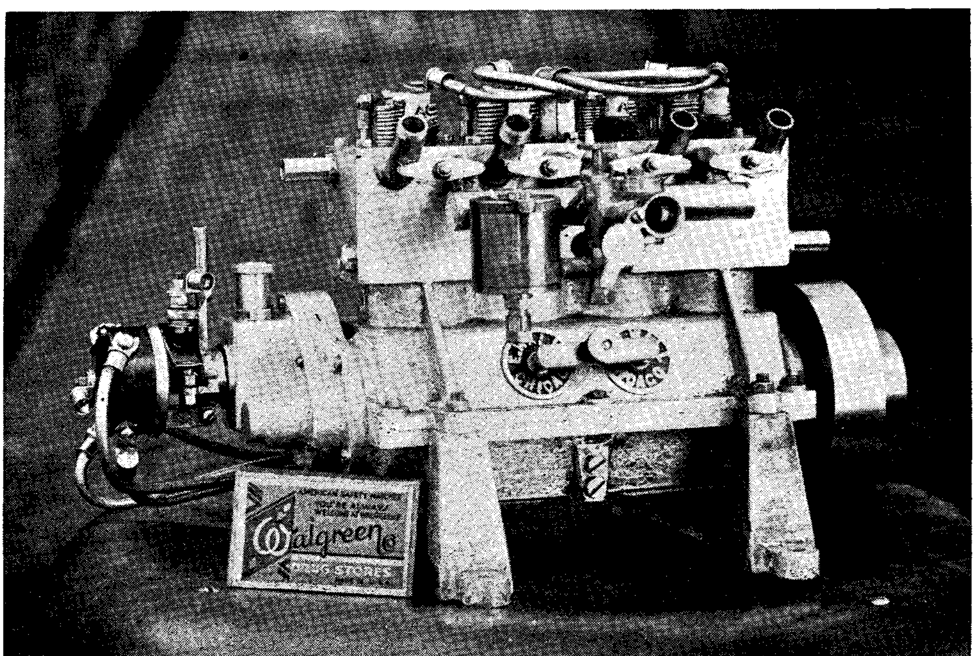
By EDGAR T. WESTBURY

THE many readers who, within recent years, have expressed a wish for more information on the subject of multi-cylinder model petrol engines will, I feel sure, be interested in this example of a small-capacity four-cylinder engine, which, as I am informed and have every reason to believe, has been very successful in practice. It has been designed and developed by my old friend Mr. Elmer Wall, of Chicago, U.S.A., who, as some readers may recollect, has done much in the past to advance the general design of model I.C. engines, and has produced a very wide variety of small engines, both of the two-stroke and four-stroke type. For nearly fifteen years I have had the pleasure of corresponding and exchanging ideas with Mr. Wall, to our mutual benefit, and I have always had a very high opinion of his ability to produce model engines which are fully up to date without being so "advanced" as to be beyond the ability or facilities of the average amateur constructor.

Several years ago he decided to exploit the possibilities of multi-cylinder models, and his first attempt in this direction which came to my notice was a very ingenious 30-c.c. twin water-cooled two-stroke engine known as the Wall "Mariner." This was followed up in due course by a four-cylinder side-valve four-stroke engine of 1 in. bore by 1 in. stroke, total capacity approximately 50 c.c., and a further development of this design appeared later with overhead valves. Although I never had an opportunity of inspecting or witnessing tests of these engines, I have no doubt of their practical success, and know that several amateur constructors in the U.S.A. have constructed successful engines to these designs, and from castings supplied by Mr. Wall.

A copy of the side-valve four-cylinder Wall engine, with a few detail modifications, has been constructed by a friend of mine, and both its appearance and performance are universally admired. This engine has already been described and illustrated in THE MODEL ENGINEER.

The majority of model engineers, however, find that an engine of 50 c.c. is too large for most purposes within their scope; not only



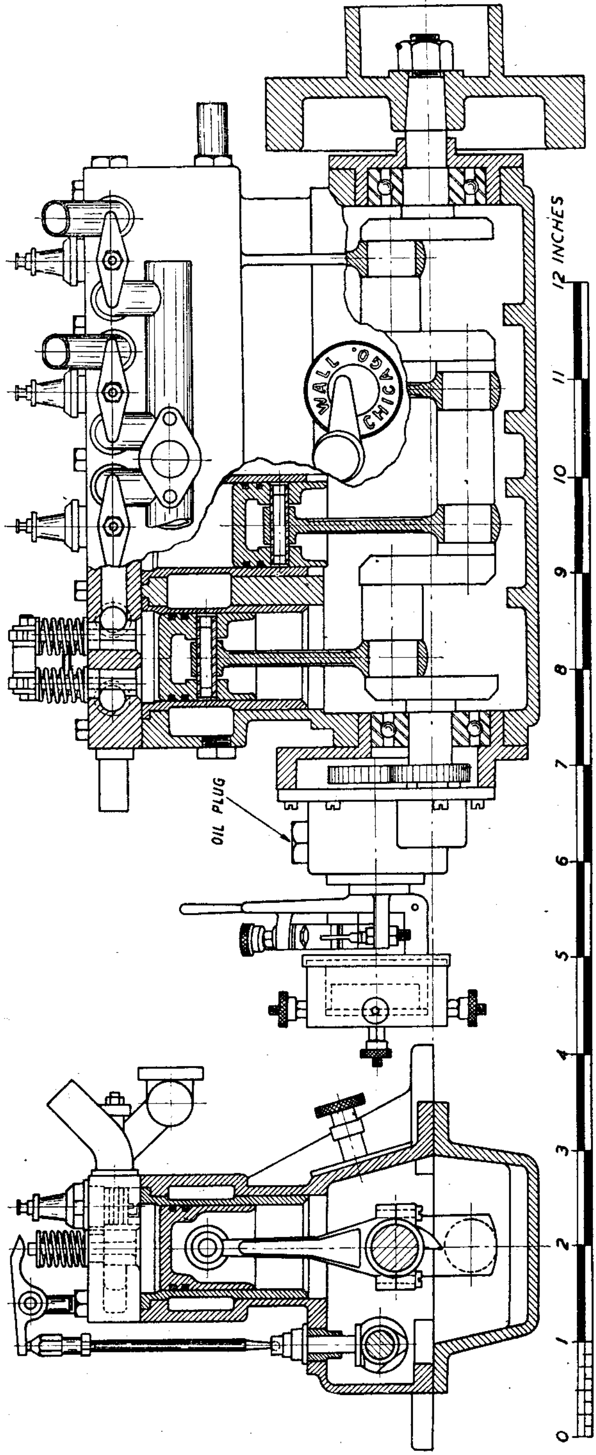
Manifold side of Wall 30-c.c. four-cylinder engine.

is its bulk and weight somewhat excessive for installation in a model boat, but it is also difficult to employ the available power to useful advantage. It is generally agreed that an engine of 30 c.c. will furnish all the power which can be used in the largest model cruiser or motorship which the amateur is likely to handle, within ordinary limitations, including that of transport.

30 c.c. The Limit

Racing engines are definitely limited to 30 c.c. in nearly all model power boat competitions in this country, but it should be noted that there are, as yet, practical obstacles to the successful development of multi-cylinder engines for the propulsion of model racing boats, and there is no claim made that these have been overcome in the engines referred to here; they are, however, capable of quite good power output, and can be turned to still higher efficiency, though, as I believe, not to the extent of a really high-performance single - cylinder engine. To revert to the question of size, however, there has for some time been a general demand for a four - cylinder engine which comes within the popular limit of 30 c.c. total displacement.

At first sight it might not be considered at all difficult to reduce an engine design from 50 c.c. to 30 c.c., while retaining all its characteristics and practical virtues; neither is it—on paper ! But the practical success of the new design is by no means a foregone conclusion ; it can only be assured by experimental development, in the course of which some modification of design is nearly always necessary or desirable. In view of the more delicate



General arrangement of Wall 30-c.c. ($\frac{7}{8}$-in. bore by $\frac{3}{4}$-in. stroke) four-cylinder water-cooled o.h.v. petrol engine.

and often congested detail work in the smaller engine, mechanical reliability often demands simplification and increased robustness of working parts, and a reduction in the number of fixing points, bolts, screws, etc., which are often found difficult to accommodate if due regard is to be paid to accessibility.

Apart from purely mechanical or structural considerations of design, however, a reduction in cylinder size nearly always introduces some functional difficulties, as most readers who have experimented with very small I.C. engines will readily agree. In a 30-c.c. four-cylinder engine the displacement of each individual cylinder is only 7½ c.c., and although many engines of much smaller capacity than this have been constructed, and have performed successfully, within the demands of performance and control which have been made upon them, it does not by any means follow that identical principles of design, combining four small cylinders in a single engine, will be equally successful.

No Advantage

It should be clearly understood that standards of performance, particularly in respect of control, which may seem at least moderately successful in a simple single-cylinder engine, would show up rather poorly in a multi-cylinder. There is absolutely no advantage in increasing the number of cylinders, unless thereby the smoothness of running, flexibility of control and balance are improved ; except in such cases as where the constructor is concerned only with appearances, which must be in a very small minority nowadays. In any engine having more than one cylinder, the additional problems of distribution, both in the ignition and induction systems, are introduced ; the former entail mechanical complication, but the latter are often much more difficult to deal with, because of their disturbing effect on smooth running and efficiency.

All these points have not only to be very carefully studied in the design of a small multi-cylinder engine, but also call for much patience and no little wit in its development. I have been in touch with many model engineers whose attempts to explore this relatively unknown territory have met with very little success, due to snags encountered either in the design, or at a later stage of progress. For this reason, an example of a successful engine is worth studying as an object lesson, even though there may be no very obvious features to account for its practical success.

Straightforward Design

The most noteworthy feature of the Wall 30-c.c. four-cylinder engine is the straightforwardness of the design, which not only simplifies construction and promotes mechanical reliability, but also limits the sources of functional problems and facilitates the diagnosis and rectification of faults. Many well-known engines in the past have largely owed their practical success to their clear-cut and readily understood principles of design ; I could name several automobile and motor-cycle engines, and at least one aircraft engine, to which this applies.

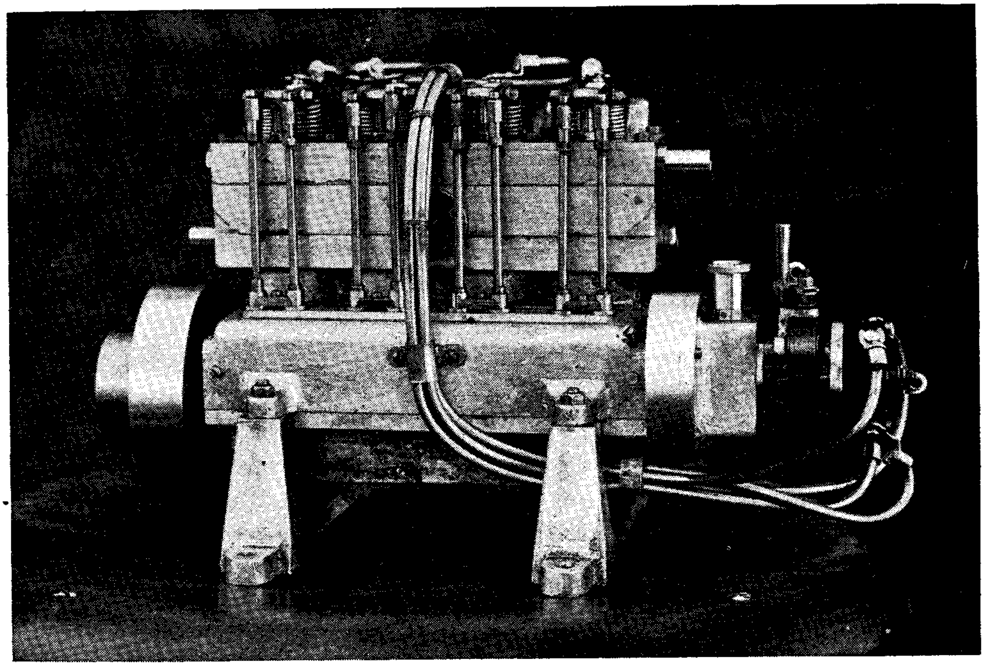
The upper half of the crankcase, incorporating the cylinder jackets, consists of a single monobloc casting, the lower half or sump being a relatively light casting, which is not highly stressed, and is easily removed for inspection. Only two main bearings are employed for the crankshaft, these being in the form of heavy duty ball-races, which are housed in endplates attached to the crankcase, one of which is integral with the timing case. The crankshaft is of massive design, so as to take working load without deflection, and has the crankpins arranged in the usual order for engines of this type, to produce "mirror" balance by the opposition of inner and outer pistons. Cast bronze connecting-rods with split big-end bearings, equipped with oil splashers, are employed.

The cylinders are fitted with "wet" liners, pressed in from the top end, and ample water circulation space is provided around them. A monobloc casting of simple design forms the cylinder-head, and has the water-cooling spaces and valve ports cast in it. The arrangement of valves, rockers, and sparking-plugs in or on the head provides the utmost simplicity in machining and construction.

Valve Operation

Valve operation is by means of a side camshaft driven by spur gearing from the crankshaft, the cams operating directly on flat-ended vertical tappets, which are connected to the valve rockers by push-rods, fitted with adjusting thimbles to take up tappet clearance. These parts are also arranged in the simplest and most direct manner possible. An extension of the camshaft carries the combined contact-breaker and distributor at the timing end.

A built-up induction manifold is fitted, communicating with four ports in the head block. Exhaust is by four individual pipes, but these can, of course, be combined into a single manifold system if desired. Both inlet and exhaust pipes are held in place



The Wall 30-c.c. four-cylinder engine, camshaft side view.

by means of four bridge clamps, each of which is drawn up by a single stud and nut.

Lubrication is by means of a simple splash system, the sump having troughs under each big-end. Oil is introduced, either periodically or continuously, through a plug on the timing case. Two inspection doors, held in place by a single bridge clamp and hand nut, are provided on the manifold side of the crankcase. Bridge clamps are also used to hold down the tappet guides.

All Essentials, but no Frills

Those who favour greater elaboration and detail in design will readily appreciate that this engine, which incorporates all essentials, but no frills or superfluities, might be used as a basis for the development of a more complete and " sophisticated " design, which would satisfy the most fastidious " super-detail " critic. The important point, however, is that in its present form it is a thoroughly successful working model, and needs no " improvement " to make it into a most satisfactory power unit for a fast model launch or cruiser, which would be far more characteristic both in proportions and appearance, than the usual steam plant or other motive power usually fitted to such craft.

It will be obvious that both the bulk and weight of this engine are a good deal greater than that of the usual single-cylinder 30-c.c. petrol engine. This may be a disadvantage in some cases, but in the present stage of model engine development, is practically unavoidable. Those readers who have been interested in the application of a four-cylinder petrol engine to model locomotive propulsion will realise that the length of the engine, when added to that of the necessary transmission gear, may make its accommodation in the chassis a difficult problem, though not necessarily an insuperable one, if the entire locomotive design is adapted to suit the plant. It would be almost impossible to install in the chassis of " 1831," unless a totally new system of transmission were involved.

Mr. Wall markets complete sets of castings and parts for the construction of this engine in the U.S.A., but there are at present very obvious and insuperable obstacles to sending them over here at present. In these circumstances, I am sure that he would not object to readers of THE MODEL ENGINEER copying or adapting the design for their own individual use. As a highly interested and enthusiastic student of design, I should appreciate it if anyone doing so would keep me in touch with his progress on this venture, and favour me with a glimpse of the finished product.

Letters

In Defence of a Cheap Lathe

DEAR SIR,—Being a machine-tool fitter and turner, I have read with interest the letters and articles on lathe design, and I would like to say a few words in defence of the so-called cheap machine. About five years ago, I decided to invest in a new lathe for my workshop, and after studying various makes I bought a 3½-in. super "Myford," owing to being able to get 2 ft. between centres; this I have never regretted. On receipt of this machine, I was agreeably surprised at the high quality and rigidity of castings.

After running it in its original condition for twelve months, I wished to put on some additions, and as this entailed various alterations, I decided to refit the whole machine. The lathe was, therefore, stripped and all the slides were machined square on their sides and cut out for proper angle strips, in preference to the flat steel gib plates; and as the lathe was required for light production work, a turret was made and fitted on the top slide; also, I provided a tumbler reverse and screwcutting indicator. The three-speed cone was machined on the inside to cut out vibration when running at high speed.

The split parallel bearings give good results when properly adjusted; and when planing between centres (cutting petrol lighter wheels with tool sideways) they require only one touch with a spanner and they are locked solid. All screws were replaced by their appropriate size of Allen socket-head screws.

Since carrying out these alterations, the lathe has given every satisfaction on all types of work.

Yours faithfully,
GEORGE W. WHITWORTH.
Luddenden Foot.

Clubs

The Society of Model and Experimental Engineers

There will be an Ordinary Meeting at The Caxton Hall, Westminster, on Saturday, 11th April, 1942, at 2 p.m., when Mr. J. R. Clark will give a lecture on "Railway Photography," illustrated by lantern slides. At this meeting the silver medal and certificates of merit, for work exhibited at the Annual General Meeting, will be presented.

Visitors' tickets and full particulars of the Society may be obtained on application to the Secretary, H. V. STEELE, 14, Ross Road, London, S.E.25.

Stephenson Locomotive Society

Interesting features of recent meetings at the Newcastle Centre have included a "Railway Quiz," when 30 questions of locomotive and similar topics, set by Mr. W. J. Fill, were put to the members present, who for the occasion were divided into teams "A" and "B." The points awarded for correct answers indicated the extent and versatility of many members' railway knowledge. On another afternoon "ten-minute papers" were presented on "Tunnel Construction," "The Ashington Coal Company's Locomotives," "The Firm of Hawthorn, Leslie & Co.," "The Down Cornishman," and "Early Memories"; photographic illustrations being supplied by means of the episcope. General meetings have been resumed in London, and informal gatherings continue to be held in Edinburgh and Glasgow. Acting General Secretary: J. H. SEAFORD, Woodlands Cottage, Fulmer Road, Gerrard's Cross, Bucks.

The City of Bradford Model Engineers' Society

Future meetings of the above Society are: April 19th, Channing Hall, at 10.30 a.m., Mr. W. D. Hollings will give a lecture on "Pattern-making and Foundry Practice for Model Engineers."

Sunday, May 17th, Channing Hall, at 10.30 a.m., Mr. A. Chubb will give another of his interesting lectures, the subject being "Timekeepers, Ancient and Modern."

The Junior Institution of Engineers

Friday, 10th April, 1942, at 39, Victoria Street, S.W.1, at 6 p.m., Ordinary Meeting. Paper, "Fuel Feed and Carburation Systems as used on Automobile Engines," by W. Dyson (Assoc. Member and Durham Bursar).

Saturday, 18th April, 1942, at the James Watt Institute, Birmingham, at 2.30 p.m. Midland Section. Special Meeting, Demonstration and Talk, entitled, "Synchrophone as an Aid to War-time Training," by N. Sandor, M.I.Mech.E.

The Annual Luncheon of the Junior Institution of Engineers will be held on Saturday, the 25th April, 1942, at the Holborn Restaurant, High Holborn, W.C.1, at 1 o'clock for 1.30 p.m.

NOTICES.

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

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